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MATRIX Report 62-11

A FIELD SURVEY OF A SELF-TUTORING COURSE FOR ON-SITE TRAINING IN SAGE AN/FST-2 TROUBLESHOOTING

TECHNICAL DOCUMENTARY REPORT NO. ESD-TDR-62-346

NOVEMBER 1962

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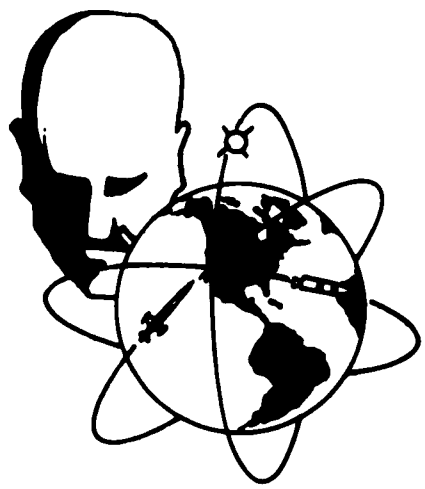

(Prepared under contract #AF 19(628)-1953 by The MATRIX Corporation
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ABSTRACT

A field survey was conducted to determine the present status of a self-tutoring course for on-site training in SAGE AN/FST-2 trouble-shooting. The materials were originally issued to AN/FST-2 sites in the New York and Washington Air Defense Sectors in the spring of 1961. The purpose of this survey was to determine any problems which might relate to the reissuing of the materials on a more extensive basis. In general the materials were well received in the field. However, two classes of problems were revealed. One is administrative in nature, while the other is technical. These problems are fully discussed and suggestions in the form of recommendations for their solution are offered. It was concluded that it would be feasible and desirable to reissue the materials.

PUBLICATION REVIEW AND APPROVAL

This Technical Documentary Report has been reviewed and is approved.

FOR THE COMMANDER

WALTER E. ORGANIST
Chief, Operator Performance Div.
Operational Applications Laboratory

WILLIAM V. HAGIN
Colonel, USAF
Director, Operational Applications Laboratory

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INTRODUCTION

This report is in compliance with Item 6 of Contract AF 19(628)-1953. This portion of the contract calls for field studies to be conducted at any four long range radar sites situated in the Washington Air Defense Sector. The purpose is to determine the utilization of the AN/FST-2 training materials which were issued to the field in March 1961. The findings are to be incorporated as appropriate in connection with a reissue of these materials.

BACKGROUND

Whenever complex equipment which must be maintained by Air Force technicians is installed at a site which is removed from a large base of operations, a system dependability problem is created. That is, in order to keep such equipment "on the air," it is necessary that the responsible maintenance technicians be capable of recognizing and isolating faults as well as effecting rapid repairs. Ordinarily, however, technicians who graduate from service schools and who are newly assigned to on-site maintenance are not fully capable of the performance that is required of them. This results from lack of operational equipment at training establishments and lack of adequate time within an enlistment period to carry out a complete training program and yet obtain useful work from maintenance technicians. In fact, sometimes it can be observed that technicians who have been on the job for several months are still not capable of performing all the maintenance tasks required of them. This state of affairs creates a requirement for further training after a technician has been assigned to an operational installation. Such on-site training is difficult at small sites with small numbers of diverse kinds of maintenance technicians. There are two reasons for this: it is not economically feasible to maintain professional instructors at small sites; and, it is difficult to schedule classes at operational sites because scheduled classes interfere with site operations and must, therefore, be given second priority after the required daily work routine has been accomplished.

This combination of circumstances creates a requirement for on-site training without the availability of professional instructors and without opportunity to schedule formal classes. It was in order to meet this requirement that the Operational Applications Office,[1] Air

[1] Now, Operational Applications Laboratory, Electronic Systems Division, Air Force Systems Command.

Force Command and Control Development Division, Air Research and Development Command sponsored a contract with Psychological Research Associates, Inc.[2], to demonstrate the feasibility of employing an automated tutoring approach for such on-site training.

The AN/FST-2 was selected as the vehicle for this study. The AN/FST-2 is part of the SAGE system. Its purpose is to provide quantitized radar data to SAGE Direction Centers. The data transmitted for Long Range Radar Sites are filtered, unwanted radar returns and clutter having been eliminated before transmission. As a part of the twenty-four hour a day function of the SAGE system, it is necessary that the AN/FST-2 exhibit a high degree of operational dependability. Therefore, maximum performance capability on the part of the maintenance technicians is required.

The principal activities of AN/FST-2 maintenance technicians include both preventive and corrective maintenance. Analysis of technician performance of these duties, which was accomplished preliminary to the study reported here, revealed that the formal schooling background of these technicians was satisfactory. However, this analysis also revealed that the troubleshooting performance capability of technicians, even after a year or more on the job, was still in need of improvement. This situtation thus provided an ideal environment for attempting to demonstrate the usefulness of a self-tutoring training program for accomplishing on-site improvement of maintenance performance.

The specific troubleshooting performance capability that was selected for the purpose of the demonstration did not, however, include all of the activities required to carry out fault isolation in the AN/FST-2. Rather, the performance capability which was selected as the target

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[2] Now, The Matrix Corporation.

of the self-tutoring on-site training program was the use of built-in indicators to carry out the first phase of the troubleshooting process on the Fine Grain Data Section only. Having selected the specific troubleshooting performance which was in most need of improvement by on-site training, the primary goal of the study became that of attempting to demonstrate that a prototype self-tutoring program could be developed which would account for a major improvement in the desired troubleshooting performance capability. A secondary purpose of the demonstration was to develop information which could be employed to improve the prototype self-tutoring troubleshooting course so that it might be feasible later to develop self-tutoring training materials for use at AN/FST-2 operational installations.

PROCEDURE

Briefly, the demonstration can be described as a simple two group experimental design. Fourteen trained and experienced AN/FST-2 maintenance technicians were selected as subjects for the demonstration. These technicians were sorted on the basis of experience and ability to form seven matched pairs. One technician from each pair was assigned to the "Non-Trained" group which was simply administered an eight-item troubleshooting performance test. The other member of each pair was assigned to the "Trained" group which was administered a prototype self-tutoring training course and was then given the same troubleshooting performance test. The scores achieved on the performance tests provided the basis for inference about improvement in troubleshooting performance that was effected by the prototype self-tutoring course.

The subjects for the demonstration were Air Force enlisted technicians who had completed the formal AN/FST-2 course at Keesler Air Force Base and who also had experienced six months to two years

of on-site training and work. These subjects were selected and matched on the basis of age, rank, and skill level.

The demonstration was conducted at three different operational SAGE Long Range Radar Squadrons within the jurisdiction of the Washington Air Defense Sector in May of 1960. Subjects in the "Non-Trained" group were simply administered the performance test. Technicians in the "Trained" group were first administered the prototype self-tutoring training program which required approximately five hours of continuous training. These technicians were then given the same performance test as was administered to the "Non-Trained" group. During this testing, men in the "Trained" group were encouraged to use three job aids which they had been taught to use during the course, whereas technicians in the "Non-Trained" group did not use these job aids. The data collected were the subjects' guesses about the location of the inserted malfunction and the time required to make such a guess.

RESULTS

First, it should be noted that the demonstration showed that the attempt to "automate" the course was successful in that the "Trained" group was able to proceed through the training materials without need for supplementary instruction by administrative personnel.

The prinicpal question to be answered by the demonstration was whether or not the "Trained" technicians would perform reliably better on the performance test then would the "Non-Trained" technicians. The question is answered by the data presented in Table 1 below.

TABLE 1

TOTAL NUMBER OF CORRECT SOLUTIONS
BY TECHNICIANS BY TRAINED AND
NON-TRAINED GROUPS

Matched Technician Pair	Trained	Non-Trained	
		Strict	Lenient
1	7	2	4
2	7	1	1
3	4	1	3
4	7	2	4
5	6	3	5
6	6	1	1
7	4	0	0

It can be seen from an examination of Table 1 that all seven of the "Trained" technicians performed better on the evaluation test than did the "Non-Trained" technicians who were matched to them. Thus, these results indicate that the training and job aid materials effected a highly reliable improvement in the performance of the "Trained" subjects on the evaluation test. Not only is the improvement highly reliable, as demonstrated by the fact that seven out of seven matched pairs favored the "Trained" technicians, but the difference is also rather large in terms of absolute gains. Whereas the "Non-Trained" technicians made 46 out of a possible 56 errors (using strict scoring), the "Trained" technicians made only 15 out of a possible 56 errors when their

performance was scored even more strictly than that of the "Non-Trained" technicians. Table 1 presents data for the "Non-Trained" group in terms of both strict and lenient scoring. Data have been presented in this manner to show that even when the greatest possible credit is given to the "Non-Trained" technicians, they scored less well on the evaluation test than did the "Trained" personnel. This is true even though the latter necessarily had to be scored in terms of whether or not they identified the precise functional area containing the trouble as defined in the lesson materials, whereas the "Non-"Trained" technicians were required only to identify the location of the malfunction to the broad system areas more commonly used in troubleshooting the AN/FST-2.

The discussion thus far has dealt with the success-failure dimension of troubleshooting performance. There is another dimension which is also of interest — that of time. In the operational situation a successful solution which requires eight hours is less good than a successful solution to the same problem which requires only ten minutes. An analysis of the time scores revealed that the "Trained" group was superior with respect to solution time as well as with respect to the number of correct solutions achieved. Thus, approximately seventy-five per cent of the correct solutions achieved by the "Trained" group were accomplished within six minutes, whereas less than half of the successful solutions achieved by the "Non-Trained" group were accomplished within a six-minute time period. Effective use of the built-in indicators to localize a malfunction to a small area in six minutes may save hours of troubleshooting as compared with gross (but essentially correct) localization in fifteen minutes. Thus, as troubleshooting progresses beyond the first phase, toward which the training materials under discussion are oriented, it can be expected that the time difference between the "Trained" and "Non-Trained" groups would become greater and greater.

THE DEVELOPMENT OF THE FINAL MATERIALS

The demonstration of the prototype materials described above offered sufficient evidence in regard to the feasibility of enhancing troubleshooting performance through the use of self-tutoring materials to warrant further development. In addition, all three of the squadrons which participated in the demonstration requested copies of the job aids which were an integral part of the training program. The Matrix Corporation entered into a new contract in the summer of 1960 to revise the prototype materials into a storyboard or script format suitable for producing a filmed version of the materials for use in a "teaching machine."

The results of the demonstration revealed certain deficiencies in the prototype training materials. Further, due to the time constraints imposed on the prototype development program, it was impossible to perform any extensive retrofit of the materials during the course of the study. Therefore, the translation of the prototype materials to a storyboard format was not merely a translation of form but a complete revision of the earlier course. Thus, the troubleshooting procedures and materials were modified in accordance with the results of the previous study as well as the self-tutoring program which conveyed the necessary skills and knowledge to the student.

The storyboard version of the materials was submitted to the contractor in the late summer of 1960. At this time, The Matrix Corporation began the development of a version of the materials for immediate release to the field. The prototype materials were not suitable for field use aside from the required technical revisions revealed by the feasibility demonstration. For example, their implementation required Matrix personnel to serve in an administrative capacity which was not compatible with extended on-site training.

The report[3] which covered the feasibility demonstration described above also contained a delineation of the functional requirements for a fully automated presentation of the training program. The storyboard materials were developed in accordance with these requirements. However, the device for presenting the filmed materials was somewhat beyond the state-of-the-art of existing off-the-shelf projectors at that time. Thus, some development time and costs would have been involved to place the filmed version in the field. It was, therefore, decided to develop the revised storyboard materials in textbook format for use in the field as the most expeditious way of meeting the requirement for early placement of an on-site training program in the field.

The translation of the storyboard materials into a finalized end product was once again more than a mere translation of form. That is, the storyboard materials were not merely revised to be compatible with a textbook presentation, but the troubleshooting procedures and the self-tutoring program were even further refined. These materials were delivered to the field in March of 1961. However, they were only issued to four sites in the New York Air Defense Sector and to six sites in the Washington Air Defense Sector.

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[3] Design and Evaluation of a Self-Tutoring Method for On-Site Training in SAGE AN/FST-2 Troubleshooting. AFCCDD-TN-60-26.

THE FIELD SURVEY

In the late summer of 1962, The Matrix Corporation was requested by the Operational Applications Laboratory to print additional copies of the training materials described above for distribution to all SAGE sites containing the AN/FST-2. It was also requested as part of this same task that a field study be conducted prior to issuing the materials on the extended basis. The purpose of this study as stated in the request would be to utilize to the optimum the original materials. Therefore, the study had to be conducted at sites which had received the materials in March of 1961. Four sites in the Washington Air Defense Sector were selected for this purpose.

It was originally planned to conduct a study similar to that which was utilized for the demonstration of the prototype materials as has been previously described in this report. However, the situation which obtained in the field precluded such an effort and dictated instead a survey type of approach. Indeed, the structure of the present field environment constitutes one of the major findings of this survey as will be reported below.

NATURE OF THE SURVEY

The survey was conducted in October and November of 1962. It consisted primarily of interviews with qualified representatives of the four sites involved. These representatives included the Commanding Officers, C&E Officers, Philco Site Engineers, and senior enlisted personnel assigned as maintenance technicians to the AN/FST-2. In one case, it was also possible to interview a Burroughs Technical Representative who was one of the Course Monitors and custodians of the original materials. He was visiting one of the other sites to help correct a major difficulty but was no longer permanently

stationed in the Washington Air Defense Sector.

An informal questionnaire was prepared to help structure the introductory portion of the interview. This questionnaire consisted of the following items:

1. How many people trained on the original materials?

2. How many of these people are still with the organization?

3. How many AN/FST-2 maintenance technicians are allocated to this organization?

4. Are the job aids being utilized on the job during actual troubleshooting?

5. General Comments:
   a) Problems
   b) Suggestions

RESULTS

1. The first finding which by itself would have been sufficient to render a quantitative type study nearly impossible is that none of the sites visited are now staffed with a Burroughs Technical Representative. Since the Burroughs Corporation was the prime contractor for the AN/FST-2, their Technical Representatives were assigned the role of Course Monitor and custodian of the materials issued in March of 1961. As such they were responsible for seeing that the materials were used, participating in the training program as required, and giving the final examinations.

As a result of their departure the training materials had, for the most part, fallen into disuse. The materials were being used in some instances, as will be discussed later, to aid in cross-training newly arrived personnel on the AN/FST-2; but in general, they were not being used as originally intended.

Further, had an actual field study been undertaken, it would not have been feasible to utilize the final examinations contained in the Course Monitor's Manual. These examinations are in the nature of actual performance tests wherein a malfunction is inserted in the equipment and the student is asked to identify its location in terms of one of the functional boxes presented on the Guess Diagram job aid. While these malfunctions are inserted by operating certain switches rather than inserting faulty components, it still requires the presence of someone thoroughly familiar with the equipment as well as the training materials to administer the examination and evaluate the results.

2. The second finding of major interest is the composition of the personnel at the four sites visited. This information is partially summarized in Table 2 below.

TABLE 2

TOTAL NUMBER OF PERSONNEL TRAINED ON THE MATERIALS VERSUS TRAINED INDIVIDUALS STILL REMAINING AT EACH SITE

Site	Total Number Trained	Number Trained Remaining
1	4	1
2	4	2
3	5	0
4	8	1

It can be seen from observing Table 2 that a matched group comparison of personnel trained on the materials versus those not trained on the materials in the manner of the previous study would not have been possible. However, Table 2 does not convey the entire picture. The personnel remaining who were trained on the materials which were issued in March of 1961 are by now senior individuals. Further, they were among the original input personnel to the system. This means that they were rigorously selected and then exposed to the formal AN/FST-2 course at Keesler Air Force Base. The more recently assigned personnel are cross-trainees. Their backgrounds range from radar technicians to clerical personnel. It will also be recalled from the discussion of the feasibility study which was reported earlier, that the technicians in the "Trained" group were exposed to the prototype materials for a five-hour period. These five hours were continuous except for one ten-minute break. The final materials are designed for a different type of usage. The student is directed to proceed at a far more leisurely pace at spaced intervals. Therefore, it would not have been possible to obtain a "Trained" group from among those technicians now undergoing cross-training in the time available.

The sites are generally allocated eight AN/FST-2 maintenance technicians each. This quota is not filled at the sites which were visited during the course of this survey. Thus, the sites are undermanned both qualitatively and quantitatively. This places the burden for conducting cross-training in addition to maintaining the equipment in an operational status on the few remaining qualified personnel.

The training materials under discussion were designed to supplement the training of personnel who had taken the AN/FST-2 course at Keesler Air Force Base. However, studies conducted by The Matrix Corporation on our own personnel reveal that the materials are also useful for people who have not taken the course at Keesler. This finding was substantiated by this survey in that the general

troubleshooting strategy presented in the early lesson blocks is being used in the cross-training now being conducted. Likewise, as the personnel progress in their knowledge of the equipment and its theory of operation, they are also introduced to the later lesson blocks which deal specifically with the AN/FST-2.

3. The general comments in regard to the training materials which were elicited from the personnel interviewed during the course of this survey ranged from "pretty good" to "excellent." The most unfavorable comment, made by an individual, was in regard to the early lessons. In his opinion the generalized troubleshooting strategy presented in the beginning lesson blocks tended to "talk down to the men." Yet, as has been mentioned, some of the individuals interviewed felt the generalized troubleshooting strategy was useful for cross-training purposes.

A unanimous opinion was expressed to the effect that the materials were satisfactory for the purpose for which they were intended. That is, they imparted a logical approach to troubleshooting and effected a more efficient use of the built-in system indicators, i.e., significantly improved Phase I troubleshooting. On the other hand, as will be discussed in more detail below, it was stated that the materials do not go far enough especially in view of certain recent modifications to the equipment and the type of personnel now undergoing training.

4. The inquiry of the questionnaire in regard to the use of the job aids during current troubleshooting received a negative response at all of the sites. Obviously, the site which does not have anyone remaining who was trained on the materials could not have answered otherwise. Yet this reply was contradicted at the other sites by the fact that the job aids are used when a fault cannot be localized in any other fashion.

Further, questioning revealed that the men trained on the materials tended gradually to combine the recommended procedures with their own pet short cuts. Thus, any given AN/FST-2 will, through time, tend to develop its own peculiar pattern of malfunctions. A maintenance technician gradually becomes familiar with this pattern and automatically assumes if his machine develops a fault that it will be in a given functional block. However, on those occasions when this assumption proves erroneous, those technicians who were subjected to the self-tutoring materials will revert to using the procedures and job aids in the prescribed fashion.

5. The most serious finding of the survey in regard to the future use of the training materials relates to the fact that the AN/FST-2 has undergone three major modifications since the time that the materials were developed. These modifications are: 1. the solid state Special Identification Feature (SIF), 2. the Clutter Mapper, 3. the Multiplexer.

This problem would not be too serious if the changes were merely additions that would not interact with the Fine Grain Data Section in a way to cause the procedures imparted by the training materials to be inaccurate. That is, if the materials are merely lagging the changes, the net effect of the modifications would be passive. However, if there is an interaction such that the materials are misleading, the net effect could lead to a performance decrement.

A penetrating analysis was devoted to this question which is even further compounded by the absence of the Burroughs Technical Representatives. At one site the Commanding Officer felt sufficiently concerned with this problem to take time out from his schedule in order to participate in the discussion at some length.

The best consensus of opinion resolved the question in the following manner. While it would be desirable to have materials which cover the SIF, the presence of the SIF will not seriously affect the validity of the procedures recommended by the present training materials. The Multiplexer seems to affect only the phone line priority at the final system output, and the total effect is not considered to be serious. The Clutter Mapper poses the most serious problem because it will affect the RAPPI readout. However, it was felt that this effect could be minimized if the Clutter Mapper is left in the standard position while troubleshooting is being accomplished. Most important, it was felt that at any site which still has the services of a Burroughs Technical Representative or other highly qualified personnel any negative interaction could be readily accounted for and the training materials would still be useful. It was, however, strongly urged that the materials be updated at the earliest possible opportunity.

6. The most frequently expressed dissatisfaction, which was encountered at each of the four sites covered by the survey, was that the materials did not go far enough. This is especially true in view of the cross-training problem now being encountered. It must be remembered that these materials were only intended to cover the first phase of troubleshooting. It is this phase which was found to be most neglected by the course at Keesler. However, the problem which now exists in the field, at least at the sites visited, is to cross-train men who have not been exposed to the Keesler course into finished maintenance technicians. Thus, it was urgently requested that similar materials be developed which would cover the second phase of troubleshooting which involved the use of the oscilloscope for fault isolation to the component level. It was also urged that these materials be combined with updated Phase I materials as recommended above.

DISCUSSION

The results of the survey can generally be classified in terms of two major categories, one administrative and the other technical.

1. Administrative

The administrative problem stems from the fact that the Burroughs Technical Representatives who were designated as Course Monitors and custodians of the training materials are no longer available at many of the sites in the 26th Air Division. This problem may not exist in some of the more recently activated SAGE sectors in the southern and western parts of the country, where it is likely that the Burroughs personnel are still available. However, even in those instances where the Technical Representatives are available they probably do not lend the necessary official status that an Air Force officer could supply. Thus, the C&E Officers should be designated the custodians of the materials that are to be issued in the near future, and an appropriate cover letter will account for this action (See Appendix A). This, of course, will not prevent him from delegating the role of Course Monitor to a Burroughs Technical Representative should one be available; but the responsibility for seeing that the materials are utilized should remain with the C&E Officer.

2. Technical

The technical category subsumes two other classifications, one dealing with personnel and the other with the equipment.

a) Personnel -- The personnel problem stems from the fact that replacement personnel are not of the same caliber as those who constituted the original system input. For example, they have not been exposed to the formal AN/FST-2 course at Keesler Air Force Base and,in some instances, do not possess any electronics background. Once again this situation may not be true in the more recently activated SAGE sectors in the South and West. However, it will eventually pose a problem at all sites.

The problem as it relates to the use of the training materials is that any deviations due to updating of the equipment would have a greater effect on this type of relatively untrained personnel. Second, they have a greater need for Phase II training than do graduates of the course at Keesler. Thus, the present materials are not sufficiently comprehensive for their use. This problem could be solved by updating the Phase I materials and developing Phase II materials.

b) Equipment — The technical problem derives from the fact that the AN/FST-2 has undergone three major modifications since the materials were developed. The modification which will have the most serious consequences in terms of the usefulness of the present materials is the Clutter Mapper. The materials do not appear to be invalidated by these modifications but they should be updated as soon as possible.

For the present time any discrepancies which arise as a result of the relatively recent modifications to the equipment can be handled by qualified personnel acting in the role of Course Monitor. It has also been suggested by personnel interviewed during the course of this survey that the Clutter Mapper should be left in the standard position while utilizing the troubleshooting procedures recommended by the self-tutoring course.

RECOMMENDATIONS

1. It is recommended that the self-tutoring course for on-site training in SAGE AN/FST-2 troubleshooting be reissued to the field on a more extended basis.

2. It is recommended that an appropriate cover letter be included with the materials sent to each site which will designate the C&E Officer as the individual responsible for the training program and custodian of the materials (See Appendix A). The purpose is to account for the administrative problems disclosed by this survey.

3. It is recommended that an enclosure be submitted with each of the Course Monitor Manuals to the effect that the training materials do not reflect the three major modifications to the equipment (See Appendix B). Suggestions will be made to offset any discrepancies which may occur. The purpose is to account partially for the technical problems disclosed by this survey.

4. It is recommended, at the request of the personnel interviewed during the course of this survey, that the training materials which deal only with the first phase of troubleshooting be updated to account for the recent modifications to the equipment.

5. It is recommended, at the request of the personnel interviewed during the course of this survey, that a similar self-tutoring course for on-site training in SAGE AN/FST-2 troubleshooting be developed for the second phase of troubleshooting to the component level.

APPENDIX A

COVER LETTER

The Matrix Corporation

3 December 1962

Commanding Officer

Dear Sir:

The enclosed materials provide a programmed course of instruction for on-site training of AN/FST-2 Maintenance Technicians. Programmed instruction pertains to training materials which require a minimum of interaction between the student and a teacher or instructor in the usual sense. Thus, "instructor" time as well as scheduling problems are reduced to a minimum.

The course is designed to supplement the troubleshooting capabilities of graduates of the AN/FST-2 course conducted at Keesler Air Force Base. However, it has also been demonstrated to be useful for personnel who are assigned to the AN/FST-2 without benefit of the formal training conducted at Keesler.

The course materials consist of six (6) items:

1) A "Course Monitor Manual" which contains complete instructions on the use of the materials for the custodian, a description of each lesson block, and a series of final examination problems.

2) A "Textbook" which presents the training materials and provides places for the student to record his responses to the various problems. Because the student records his responses in this book, it is only usable for a single administration.

3) An "Answer Book" which contains the answers to the various consolidation exercises and lesson tests with the exception of the final examination problems. This book is programmed to be used in conjunction with the "Textbook" so that the student does not require direction or instruction from the Course Monitor in its use. The same is also true for the rest of the materials.

4) A "Diagram Book" which contains photographs of the various PPI and RAPPI displays with given malfunctions inserted in the equipment. This is programmed to be used in conjunction with the last few lesson blocks.

5) A "Guess Diagram" which is a laminated job aid scheduled for use during the training as well as on the job at the completion of the course.

6) A "Wedge Check" and "Spiral Check" are contained on opposite sides of a laminated job aid. These are also scheduled for use during the training as well as on the job at the completion of the course.

The materials cover only Phase I troubleshooting of the Fine Grain Data Section of the AN/FST-2. Phase I troubleshooting is fault isolation to a functional unit of the equipment as defined by one of the twenty-eight boxes on the "Guess Diagram". Essentially, the course teaches the student how to perform

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fault isolation based on the information presented by the built-in system readouts (PPI, RAPPI, and Warning Lights) prior to using the oscilloscope.

It should be noted that the early lessons present a generalized approach to troubleshooting which should also be useful to the student in troubleshooting equipment other than the AN/FST-2.

The course should be administered as follows:

1) The C&E Officer should be designated as the custodian of the materials. He may delegate the role of Course Monitor to either the Burroughs Technical Representative or the senior AN/FST-2 NCO.

2) Upon receipt of the materials, prior to administering the course to any of the students, the C&E Officer, the senior AN/FST-2 NCO and the Burroughs Technical Representative, if one is present, should take the course themselves.

3) The course should be administered to all AN/FST-2 maintenance technicians at a given site regardless of their qualifications or experience. This is so because it teaches a different and more efficient way of performing Phase I troubleshooting. The materials were developed in cooperation with the Burroughs Corporation and were thoroughly field tested prior to their being released to your organization.

4) The training cannot be effective in terms of on-the-job performance unless the "Guess Diagram" and the "Wedge Check and Spiral Check" job aids are available for use in the AN/FST-2 room after the trainees have completed the course. The C&E Officer is responsible for seeing not only that all of the AN/FST-2 technicians take the course but also that they utilize the new procedures on the job. The course has official ADC sanction and the materials should be treated in accordance with this status.

5) All technical questions should be referred to:

Director of Research
The Matrix Corporation
507 Eighteenth Street South
Arlington 2, Virginia

All requests for additional materials should be directed through official Air Force channels.

Sincerely yours,

Edward C. Weiss

Edward C. Weiss
Senior Research Scientist

APPENDIX B

NOTICE OF EQUIPMENT MODIFICATIONS

IMPORTANT!

Since the time that these training materials were developed, there have been three major modifications to the AN/FST-2. These modifications are: the SIF, the Multiplexer, and the Clutter Mapper. The SIF and Multiplexer should not result in any negative interactions with the troubleshooting procedures which are presented by this course. The effect of the Clutter Mapper can be minimized if the Clutter Mapper is left in the standard position while pursuing fault isolation in the manner recommended. However, as Course Monitor, you should carefully observe the effects of any modification to your particular equipment while taking the course yourself. You should then account for all such deviations prior to permitting the first student to utilize the materials.

AF Electronic Systems Division
L.G. Hanscom Field, Bedford, Mass.
Rpt. No. ESD-TDR-62-346 A FIELD SURVEY OF A SELF-TUTORING COURSE FOR ON-SITE TRAINING IN SAGE AN/FST-2 TROUBLESHOOTING. November 1962, 23 pages

Unclassified Report

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Rpt. No. ESD-TDR-62-346 A FIELD SURVEY OF A SELF-TUTORING COURSE FOR ON-SITE TRAINING IN SAGE AN/FST-2 TROUBLESHOOTING. November 1962, 23 pages

Unclassified Report

A field survey was conducted to determine the present status of a self-tutoring course for on-site training in SAGE AN/FST-2 troubleshooting. The materials were originally issued to AN/FST-2 sites in the New York and Washington Air Defense Sectors in the spring of 1961. The purpose of this survey was to determine any problems which might relate to the reissuing of the materials on a more extensive basis. In general the materials were well received in the field. However, two classes of problems were revealed. One is administrative in nature, while the other is technical. These problems are fully discussed and suggestions in the form of recommendations for their solution

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